DEVELOPMENT OF A DRAFT SPECIFICATION FOR TECHNICAL MANUAL QUALITY ASSURANCE

by

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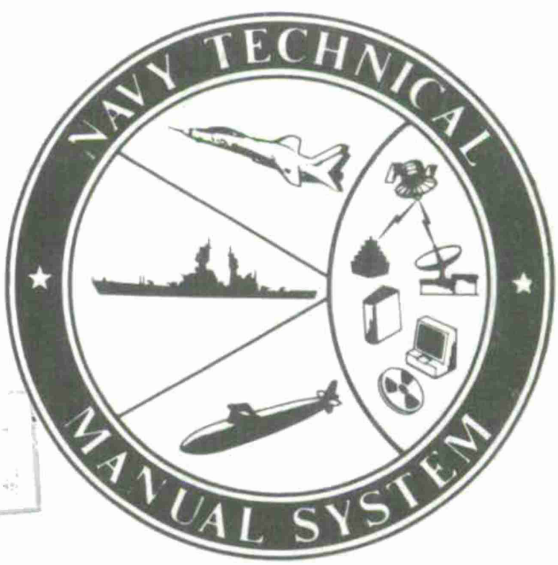

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This report presents a Draft Specification for Technical Manual (TM) quality assurance (QA), to improve the clarity and content of TM's. The draft QA specification (1) maintains the concept and fundamental methods of technical manual quality assurance, that is, validation, verification, and in-process review, which have existed for some years; and (2) provides a systematic and structured way of reviewing technical manuals under development with respect to demonstrated or at least "concensus factors" for improving comprehension and content adequacy.

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INTRODUCTION

This effort was sponsored by the Navy Technical Manual System (NTMS) Project Office located at the Naval Ship Research and Development Center (NSRDC), Carderock, Maryland. The objective of NTMS is to develop and operate an integrated Navy system for improving technical manuals through:

- Standardized procedures and specifications.
- Better presentation methods.
- Obtaining and applying feedback.
- Responsive update procedures.

Background

Previous critiques of technical manuals have identified lack of presentation clarity, problems in utilization on the job, and technical inadequacies (including both scope and accuracy) as major problem areas. All of these problem areas can be corrected or certainly improved by better quality assurance procedures. Much work needs to be done to assure that these problems are addressed on a Navy-wide basis. As a starting point, a NAVMAT-level specification needs to be developed to permit project managers and their contractors to establish and implement technical manual quality assurance procedures directed at alleviating these critical problems.

Objective

The objective of this effort was to develop a draft specification for technical manual quality assurance. The specification should be developed to be used by NAVMAT in order to promulgate policy regarding TM quality assurance and should treat both the clarity and content of technical manuals. Specific requirements are as follows:

1. Review (a) current specifications relating to TM preparation; (b) other Navy policy guidance on maintenance information and TM's; and (c) previous studies seeking to improve TM quality.

2. Summarize relevant material useful in the preparation of a TM quality assurance specification.

3. Prepare a draft specification intended to assure high quality in Navy Technical Manuals. Incorporate a specific method for effectively performing in-process reviews of TM preparation.

4. Prepare a report which outlines the rationale for the particular approach taken, documents all relevant source material, and summarizes any additional suggestions and comments dealing with assurance of TM quality.

APPROACH

The philosophy of approach for this effort was basically one of obtaining, reviewing, and synthesizing two sources of information. The first source was current specifications and policy related to quality assurance and technical manual preparation. The second source was recent new research directed toward simplifying or improving technical manual comprehension and utilization. The rationale for this philosophy of approach is also twofold. First, there are several good quality assurance and/or TM preparation specifications that have been in use for many years and have therefore already been revised to eliminate major problems. These existing specifications are also a familiar and standard concept to implement. The second reason for pursuing the stated approach is that a great deal of recent new research has been done to improve the comprehension and content (to some extent) of technical manuals, but this research has not been applied. The draft specification produced by this approach has therefore resulted in a new specification which (1) maintains the concept and fundamental methods of technical manual quality assurance, that is, validation, verification, and in-process review, which have existed for some years; and (2) provides a systematic and structured way of reviewing technical manuals under development with respect to demonstrated or at least concensus factors for improving comprehension and content adequacy.

While this new specification improves upon and expands beyond existing specifications, it does not eliminate the work required to assure technical manual quality. Neither is it a cut and dried "how to do it" document. The experience and judgment of technical publications specialists and content experts is still required. What the new specification does do is define a process and provide a framework for increasing the probability of identifying problems

early in the technical manual development process while the resolution of these problems may be accomplished easily and economically.

Specification Development

The specification per se (that is, excluding the detailed in-process review checklists) was developed in a three-step process. Step 1 was the review and synthesis of current specifications relative to TM preparation. Step 2 was a review and synthesis of current specifications (or policy) related to TM quality assurance. Step 3 was a clarification and/or expansion of the preliminary document resulting from Steps 1 and 2.

It was explained earlier that the philosophy of approach for developing this specification was to maintain the concepts promulgated in existing specifications and to incorporate a new specific method for effectively performing in-process reviews. In conformance with this approach, no attempt was made to critique or to suggest ways of implementing current specifications relating to TM preparation. However, the most common or governing specifications in this category were reviewed for their implications and compatibility with the proposed approach. In particular, the following specifications were included in this review:

a. MIL-M-38784	Manuals, Technical: General Requirements for Preparation of
b. MIL-M-6300C	Manuals, Technical: General Requirements for Manuscripts
c. MIL-M-38784A	Manuals, Technical: General Style and Format Requirements
d. MIL-M-2410B	Manuals, Technical: Functionally Oriented Maintenance Manuals (FOMM) for Equipment and Systems
e. MIL-M-15071G	Manuals, Technical: Equipment and Systems Content Requirements for

f. MIL-M-81927(AS) Manuals, Technical: General Preparation of (Microform Compatible)

The primary emphasis in developing the draft specification (excluding the detailed checklists) was to review, synthesize, and modify those specifications or policy documents specifically directed at technical manual quality assurance. Under current Navy policy, the three principal concepts for implementing TM quality assurance are validation, verification, and in-process review. Validation tests a manual for technical adequacy and accuracy and is accomplished by actual performance of manual procedures checked against the system/equipment for which the manual was written. Validation is normally conducted at the facility (usually a contractor's plant) where the manual is being prepared. Verification tests and proves technical data to determine its adequacy for operation and maintenance of equipment procured for operational use. Verification is normally conducted at an operational site, with production equipment operated and maintained by Fleet personnel. In-process review is a progressive review of technical manuals in the process of preparation. The reviews are held in order to provide guidance to assure that manuals are (1) being developed in accordance with the contract requirements and approved maintenance and support philosophy, and (2) being prepared with the highest quality presentation and usability features.

The validation and verification processes developed in the new draft specification are essentially the same in concept and procedure as they exist in the most widely used current specifications which are listed below:

a. MIL-M-81203A Manuals, Technical: In-Process Reviews, Validation, and Verification; Support of

b. NAVAIR 00-25-600 In-Process Review, Validation, and Verification Guide

c.	NAVAIR INSTRUCTION 5600.9A	Policies and Responsibilities for Management and Coordination of Technical Manual In-Process Reviews, Validation, and Verification
d.	NAVSHIPS INSTRUCTION 5600.30B	Technical Manual Management
e.	NAVELEX INSTRUCTION ELEX 490	Acquisition and Quality Assurance of Technical Manuals for New Equipment/ Systems; Requirements for

Basically, what was done in the new draft specification was not to change the concept of validation and verification, but rather to clarify and bring some consistency to the implementation of the concepts. The final version of the draft specification is incorporated as Appendix A to this report. For references purposes, an outline of the specification content is included as Table 1.

In-Process Review Checklist Development

In accordance with the general objectives and particular requirements of this effort, a specific method for effectively performing in-process reviews of technical manuals was developed. As noted earlier, in-process reviews are table-top reviews utilizing all or parts of a manuscript before negatives are prepared. Further, in-process reviews are conducted continually during the TM development. Normally, a minimum of two review conferences will be held at approximately the 10-percent and 70-percent stages of preparation. A complete in-process review consists of both a review of compliance with TM requirements (that is, applicable specifications and other contract provisions) as well as review of those characteristics of the manual that relate to its comprehension and utility. The present effort focused on development of a specific method for the latter type of review. In other words, the intent was to develop a method for effectively performing

Table 1

Outline of Draft Specification

1. PURPOSE
2. SCOPE
3. BACKGROUND
4. DEFINITIONS
5. REFERENCES
6. REQUIREMENTS

6.1 GENERAL

6.2 IN-PROCESS REVIEW

- 6.2.1 Concept
- 6.2.2 Objectives
- 6.2.3 Application
- 6.2.4 Scheduling
- 6.2.5 Participants
- 6.2.6 Convening the Review
- 6.2.7 Procedures
- 6.2.8 Reporting
- 6.2.9 Reference Materials

6.3 VALIDATION

- 6.3.1 Concept
- 6.3.2 Objectives
- 6.3.3 Application
- 6.3.4 Plan
- 6.3.5 Schedule
- 6.3.6 Procedures
- 6.3.7 Criteria
- 6.3.8 Reporting

6.4 VERIFICATION

- 6.4.1 Concept
- 6.4.2 Participating Activities and Responsibilities
- 6.4.3 Verification Plan
- 6.4.4 Procedures
- 6.4.5 Records and Reporting

7. IN-PROCESS REVIEW CHECKLISTS
8. GLOSSARY

in-process reviews related to comprehension and utilization. The method selected for doing this was the development of an extensive series of checklists based on recent and relevant research concerned with increasing comprehension and utilization of technical materials.

Fortunately, several recent research efforts have been directed toward these research objectives. Also fortunately, several of the studies were sponsored by the Navy and therefore concerned with Navy technical materials. The primary source documents for development of the checklists are listed below. A formal bibliographic citation of each of these documents is provided as a list of references at the end of this report.

- Requirements and Criteria for Improving Reading Comprehension
- Revising Technical Manuals to Improve Comprehension and Utility
- Development of Information Measurement Techniques for Quality Assurance of Navy Aircraft Maintenance Job Aids
- Technical Manual Writing - Handbook
- Improving the Readability of Maintenance Manuals
- Comprehensibility Evaluation of Technical Manuals
- Simplified Maintenance Manual Design
- Writing Training, Operating, and Maintenance Manuals to Fit Average Comprehension Levels of Navy Personnel
- Survey of Navy Technical Manual Systems and Procedures

The procedure for developing the checklists was simply an iterative process of:

1. Identifying candidate criteria or principles relevant to comprehension and utilization.
2. Preparing these candidate items in a rough checklist format.

3. Grouping or categorizing the items into meaningful "review units."
4. Rephrasing and editing the items for consistency.
5. Repeating any or all of the steps above until a satisfactory product evolved.

Ultimately, it was decided that the assembly and organization of checklist items which offered the most flexibility and applicability was as follows. Organize the checklist items into two major parts, each part with some major review categories, and several specific purpose checklists within each major category. The two parts of the checklists are as follows:

Part I PRESENTATION QUALITY - factors that relate to manual comprehension and understandability.

Part II JOB PERFORMANCE ADEQAUCY - factors that relate to adequate support of the user in the job situation.

The final version of the checklists are included as Attachments to the draft specification which is incorporated as part of this report. However, for reference and a general understanding of the content of the checklists, Tables 2 and 3 are outlines of Parts I and II.

A few specifics concerning the limitations of the checklists developed under this effort should be pointed out. First and foremost, they are checklists; they are not algorithms or quantitative techniques for evaluating a technical manual. They have been developed to provide systematic considerations of items which are directly related to quality assurance. Therefore, they do increase the probability that a diligent reviewer will detect technical manual errors or inadequacies while they are easy and economical to correct. However, the items within the checklists in most cases do not indicate methods by which a quantitative review may be performed and therefore the judgment of the reviewer

Table 2

Outline of Checklist

Part I PRESENTATION QUALITY

1. ORGANIZATION
   - A. Principal Units and Work Packages
   - B. Arrangement of Sections
   - C. Composition Practices
   - D. Prose-Graphic Balance

2. PROSE COMPREHENSION
   - A. General Style Principles
   - B. Instructions
   - C. Paragraphs
   - D. Sentences
   - E. Words
   - F. Non-Text Words
   - G. Legibility

3. GRAPHICS COMPREHENSION
   - A. General Graphics Principles
   - B. Graphic Form Selection
   - C. Schematics & Wiring Diagram Practices
   - D. Network Diagram Practices
   - E. Block Diagram Practices
   - F. Illustrations Practices
   - G. Freestanding or Series Pictorials
   - H. Tables Practices
   - I. Graph Practices
   - J. Photograph Practices

4. READABILITY MEASUREMENT

Table 3

Outline of Checklist

Part II JOB PERFORMANCE ADEQUACY

1. ACCESS AND SEARCH
   - A. Identification
   - B. Sections or Packages
   - C. Table or Contents & Headings
   - D. Index

2. USABILITY & ACCEPTANCE
   - A. Information Content Adequacy
   - B. Job Relevance and Efficiency
   - C. Work Place And User Compatibility
   - D. Technical Scope And Accuracy

is necessary. Similarly, there is no intent to provide a technique for "scoring" a technical manual with a single figure of merit. It is true, however, that a "no" answer on the checklist indicates a less than adequate or questionable compliance with the item under review and therefore corrective action may be required. It is anticipated that once all (or a selected number) of the checklists have been applied, the review team can probably detect some pattern of inadequacies from the "no" answers on the checklists. A rational decision can then be made with respect to corrective actions based on the number of questionable items and what these questionable items seem to focus on.

There has been no attempt to make the checklists mutually exclusive. In fact, there has been a planned overlap such that items that apply to more than one checklist or major category are repeated. This permits the selective use of checklists if such occasions are warranted. Likewise, the checklists are not inclusive. There certainly will be items important to in-process review and related to quality assurance which are not included in these checklists. Finally, it is readily apparent that all items will not apply to all cases. In general, the source documents from which the checklist items are prepared were oriented toward maintenance and were applicable to hard copy materials. If an item does not apply, it should simply be checked as not applicable.

All checklists have their limitations; they cannot substitute for diligent and insightful reviewers. However, it is truly hoped that these checklists will stimulate the user into a more thoughtful and persistent review than might otherwise be performed.

RECOMMENDATIONS

1. The effort presented in this report was strictly a synthetic paper and pencil effort. No empirical validation was done either on the original source data or on the resulting draft specification and checklists. Therefore, the first recommendation is to conduct some type of validation of the specification, particularly the in-process review checklists.

2. The limitations of time and resources for this effort precluded development of any more sophisticated methods for performing in-process reviews than the checklists which are included. However, almost all of the checklist items were obtained from original research performed elsewhere and specific criteria or instructions for the application of each item could be developed. It is therefore recommended that consideration be given to preparing a guide book which would be a companion to the specification checklists and provide more detailed guidance on the application of each checklist item. The guide book could also be extended to include more general considerations of technical manual evaluation such as sampling strategies, measurement criteria, and possible quantitative scoring.

3. The major emphasis of this effort has been directed toward improving the in-process review procedure. The concepts of validation and verification could also be strengthened and improved. It is therefore recommended that consideration be given to development of more detailed guidance directed at how to plan, conduct, and evaluate the results of verification and validation.

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APPENDIX A

A DRAFT SPECIFICATION

for

TECHNICAL MANUAL QUALITY ASSURANCE

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Technical Manual Quality Assurance Specification For In-Process Review, Validation, and Verification

1. PURPOSE

1.1 This specification has been prepared to standardize policy and procedures for quality assurance of Navy technical manuals acquired contractually or prepared internally under policies of the Naval Material Command (NAVMAT).

1.2 Policies and procedures are established herein for the conduct of in-process review, validation, and verification. Detailed checklists are enclosed to guide the procuring activity in the performance of in-process reviews.

1.3 It is intended that this specification be used by both Government and industry. The primary purpose of this specification is to promote a policy and procedures for use in reviewing technical manuscripts. However, the in-process review checklists can be used as guidance in the preparation of a technical manuscript.

2. SCOPE

2.1 The quality assurance elements of the acquisition process begin at the time the contract is let and end with the acceptance of the camera-ready copy for reproduction. This continual process of quality assurance is intended to detect inadequacies in the manuscript during development and evaluation, prior to production.

2.2 This specification supports the responsibilities of the technical manual (TM) quality assurance program by supporting in-process review, validation, and verification. The primary difference between this specification and preceding specifications dealing with technical manual quality assurance is the detailed guidance provided for in-process review.

2.3 In-process review, as used herein, is a table-top review process which includes the following:

a. Review of compliance with applicable TM specifications and contract requirements.

b. Review of presentation quality.

c. Review of job performance adequacy.

This detailed guidance in this specification concentrates on (b) and (c) above.

3. BACKGROUND

3.1 Technical manuals are the prime means of communicating maintenance and operational information to the user. Since the quality of technical manuals affects equipment maintainability, personnel efficiency, safety, and Fleet readiness, quality in technical manuals must be a planned objective.

3.2 The information in the technical manual must be accurate, clear, and complete. Its text and illustrations must be arranged in logical order to make this information readily accessible to the user. The content must also accurately reflect the equipment being covered and be adequate, both in depth and scope of coverage, to support the required task performance. In-process review, validation, and verification are the means of assuring that technical manuals meet these objectives.

3.3 Full approval for service use will not be granted until technical documentation necessary for support of the equipment or system has been identified and there is assurance that technical manuals have been (1) validated by the contractor, (2) verified by Fleet personnel, and (3) corrected prior to printing, and they will be delivered with the first deployed production item.

4. DEFINITIONS

4.1 Quality. Used exclusively in this specification to refer to the value of technical manual/data content to the user in terms of reliability, adequacy, accuracy, completeness, retrievability, and usability.

4.2 In-Process Review. A progressive review of technical manuals in the process of preparation. In-process reviews are held primarily for the purpose of providing guidance to the contractor or cognizant preparing activity to assure that manuals are (1) being developed in accordance with the contract requirements and the approved maintenance and support philosophy, and (2) being prepared with the highest quality of presentation and usability features. In-process review is normally a table-top review utilizing parts of the manuscript before negatives are prepared. A complete in-process review consists of three parts:

a. Compliance with TM requirements.
b. Presentation quality.
c. Job performance adequacy.

4.3 Validation. The process by which the contractor or cognizant preparing activity tests a manual for technical adequacy and accuracy. Validation is accomplished by actual performance of manual procedures checked against the system/equipment for which the manual was written. Validation is normally conducted at the preparing activity or vendor's facility. In extenuating circumstances, validation may be conducted at an operational site.

4.4 Verification. The process by which the Navy tests and proves technical data to determine its adequacy for operation and maintenance of equipment procured for operational units. Verification is normally conducted at an operational site, with production equipment operated and maintained by Fleet personnel.

4.5 Compliance With TM Requirements. A review of compliance with relevant specifications and contract provisions concerning quality assurance, technical manual general preparation requirements and content, and general style requirements. Specific items for review may be governed by applicable specifications such as those in paragraph 5, items a through e.

4.6 Presentation Quality Review. A review of those characteristics of the manual that relate to its comprehension and understandability. These characteristics include organization, format, editorial quality, readability, and other information presentation factors.

4.7 Job Performance Adequacy Review. A review of the content and characteristics of the manual that relate to its ability to adequately support the technician in performing on the job. This includes such factors as access to information, scope of coverage, technical accuracy, and work station utility.

4.8 Review Manuscript. That document presented by the contractor or preparing activity for review prior to preparation of the final reproducible copy or negatives. The review manuscript shall include all text and illustrations in a page make-up composition as it would appear in the technical manual.

5. REFERENCES

a.	MIL-M-38784	Manuals, Technical: General Requirements for Preparation of
b.	MIL-M-6300C	Manuals, Technical: General Requirements for Manuscripts
c.	MIL-M-38784A	Manuals, Technical: General Style and Format Requirements
d.	MIL-M-24100B	Manuals, Technical: Functionally Oriented Maintenance Manuals (FOMM) for Equipment and Systems
e.	MIL-M-15071G	Manuals, Technical: Equipment and Systems Content Requirements for

6. REQUIREMENTS

6.1 General. In general, the requirements for quality assurance stress the need to assess technical manuscript deficiencies with respect to contract/program requirements, the weapons system support plan, Navy maintenance concepts, procuring activity policies,

and user capabilities/needs on the job. From these broad objectives, the requirements for in-process review, validation, and verification are to provide a continuing review to determine manuscript deficiencies and provide feedback to the preparing activity while changes can be made quickly and economically.

6.2 In-Process Review

6.2.1 Concept. The in-process review is an integral part of the quality assurance program. It is intended to assure that the final TM product meets user requirements on the job. This is a table-top review of elements of the technical manual manuscript prior to production. The review is normally conducted by the TMMT, composed of data management/publications personnel. The team shall review the manuscript as often as necessary during the development and preparation of the technical manual and provide guidance as required. The reviews are normally held at the preparing activity's facility, but may be held at a vendor facility or a Government site designated by the procuring agency. Reviews conducted by the preparing activity as part of its in-house publications quality assurance program are not to be confused with the formal in-process review by the procuring activity.

6.2.2 Objectives. The objectives of in-process review are as follows:

a. Minimize deficiencies in delivered data resulting from failure of the preparing activity to fully and clearly understand contract/program requirements, Navy maintenance concept, Navy policy, application of specifications, and user capabilities/needs on the job.

b. Identify technical manual deficiencies in the early stages of development, when corrective action is economical and timely, so that technical manuals are ready for delivery in sufficient time to meet training and production schedules.

c. Assure the completion of technical manuals which meet quality requirements in terms of reliability, readability, adequacy, completeness, usability, and compatibility with approved maintenance plan/support equipment.

6.2.3 Application. All technical manuals intended for use in intermediate, organizational, or depot-level maintenance are subject to in-process review. This includes operator manuals, maintenance manuals, parts listings, and illustrated parts breakdowns that are required to support operations and maintenance.

6.2.4 Scheduling. The preparing activity shall be responsible for recommending in-process review conferences as part of the technical manual plan (or equivalent section of the integrated logistics support management plan). The schedule of in-process review conferences shall be adequate to permit the effective and timely achievement of all in-process review objectives. Normally, a minimum of two review conferences will be held at approximately the ten-percent and seventy-percent stages of preparation.

The in-process review schedule, when approved, becomes basic planning data. The preparing activity, however, may request an in-process review, irrespective of the schedule, at any time problems or milestones warranting a meeting are encountered. Similarly, the procuring activity may request an in-process review conference when deemed necessary; but, the preparing activity shall be notified in sufficient time to make adequate preparations.

In general, in-process review conferences should not be scheduled until the technical manual development process has produced the following:

a. Plans for proposed methods of data presentation and delivery have been determined.

b. Technical manual book plans or outlines have been developed, including the manual organization and basic format scheme for prose and graphics.

c. Manuscript copy has been composed into frame or page layout suitable for the preparation of negatives.

6.2.5 Participants. In-process reviews shall normally be conducted by the TMMT. In procurements where a TMMT has not been established, or if a complete TMMT is not needed, the procuring activity shall designate personnel to participate. These personnel shall consist of publications and technical personnel of both the preparing activity and the procuring activity.

Procuring activity participation shall always include the TMMA or delegated representatives. Participants should also have a technical background in the area covered by the manuscript under review; and familiarity with the specific hardware being covered is desirable. Publications specialists should be familiar with job performance aids concepts as well as information presentation techniques. Finally, participants should understand policy and procedures for quality assurance of Navy technical manuals and the specific contractual requirements of the procurement.

Preparing activity representation shall include appropriate members of the writing staff/publications group, and may include personnel from engineering, maintainability, product support, quality assurance, and contract administration as required.

6.2.6 Convening the Review. The TMMA project manager or TMMT chairman shall be responsible for convening in-process review conferences. Conferences shall be called by official correspondence which, in addition to the time, date, and place, shall specify the following:

a. The specific objectives of the conference, including those manuals, or portions thereof to be presented for review.

b. Reference documentation required.

c. Access required to preparing activity facilities or staff other than publications.

d. The exact participation required.

The TMMA project manager or TMMT chairman is responsible for determining that a conference is justified when a non-scheduled in-process review is requested by the preparing activity or recommended by the procuring activity. In some cases, a meeting between the responsible personnel of the preparing and procuring activities will serve to answer questions and provide adequate guidance. In other cases, one selected representative of the in-process review team can accomplish the required review without the need for a full team conference. Justification for a non-scheduled conference and the representation required shall be determined by:

a. The nature of the problem to be resolved or objective to be accomplished.

b. The nature and amount of documentation to be reviewed.

6.2.7 Procedures. In-process review procedures include the evaluation of TM book plans, proposed methods of data presentation, manual outlines, modes of manual preparation (including the use made of source documentation such as MEAR's and PPB's), and samples of completed documentation (text and artwork). In-process reviews may also include the review and evaluation of manuals in the manuscript stage which are ready for transition to camera-ready copy. It is through these evaluations that the in-process review team is able to guide preparing activity effort toward desired objectives.

In-process reviews shall be facilitated by the checklists presented as Attachments to this specification. These checklists cannot assure compliance with contractual requirements, nor can they substitute for expert judgment. However, the checklists will facilitate in-process review by providing a systematic consideration of items which are directly related to quality assurance. The checklists may also be used as a means to record review progress and as a means of verifying that a specific requirement has been reviewed and evaluated. When the complete checklists have

been applied, the review team should make the decisions with respect to action based on the number of questionable items checked and what these questionable items seem to focus on.

The checklists have been developed to cover two principal areas, as follows:

a. Presentation quality - factors that relate to manual comprehension and understandability.

b. Job performance adequacy - factors that relate to the adequate support of the user in the job situation.

Compliance with TM requirements contained in relevant specifications and contract provisions is not necessarily covered by the checklist items. Therefore, compliance with TM requirements which are a part of the contract should be a separate part of in-process review.

6.2.8 Reporting. The preparing activity shall be responsible for recording and maintaining decisions resulting from the in-process review conferences. The preparing activity will also provide a report of review actions to the procuring activity. The in-process review team shall then impose corrective action on the preparing activity, with a report of corrective action required within thirty days to the in-process review team chairman with copies to all team members. The in-process review team may also impose actions on Government activities.

Specific deficiencies should be identified. For example, deficiencies should be prescribed to be:

a. Items related to a particular contractual requirement.

b. Items from the attached checklists to this specification.

c. Areas of consistent or overall poor quality.

6.2.9 Reference Materials. The following documents provide basic information to support the development of the technical manual, and shall be available at in-process reviews when required for use by team members.

a. Applicable engineering analyses (MEAR's).

b. Applicable parts information (IPB's and PPB's).

c. Engineering drawings.

d. General and detail specifications applicable to the manual(s) being covered.

e. Applicable TMCR and/or CDRL.

f. The Integrated Logistic Support Management Plan or other document defining maintenance/support concept, program plans, program milestones, and manning information.

g. The approved support equipment listing or technical manual data lists.

h. Referenced manuals having impact or an interface with manual(s) under review.

6.3 Validation. Validation is an integral part of the quality assurance program of the basic contract and requires the use of general and specific techniques tailored to the preparing activity's technical data development procedures.

The preparing activity is responsible for all aspects of validation as specified herein. The preparing activity is also responsible for the proper validation of all manuals or manual data prepared by a subcontractor, vendor, or other writing activity. The preparing activity may elect to validate these manuals/manual data or require that the subactivity perform the validation. In the latter case, the preparing activity must ensure that validation performed by the subactivity meets all the requirements imposed by the TMCR.

6.3.1 Concept. Validation is a continuing effort accomplished on all technical manuals, changes, and revisions. It may

be initially accomplished as an integral part of research and development for the equipment concerned; however, it will normally be conducted during regular scheduled tests and inspection.

Validation is accomplished by actual performance of technical manual procedures checked against the system/equipment for which the manual was written. Validation is usually conducted at the preparing activity or vendor's facility, although in extenuating circumstances may be conducted at an operational site.

Principles of operation, system/component description, source codes, schematic and wiring data, operating and maintenance procedures, are validated against appropriate engineering source data or the system/equipment. The extent of validation is determined by magnitude and complexity of the procedure being checked. However, malfunctions are not usually introduced into the system or equipment unless specifically required for certification of procedural tasks or system tests.

6.3.2 Objective. The objective of validation is to assure that the preparing activity has provided accurate and adequate technical manual content for support of the weapon system in accordance with the approved maintenance/logistics support plan.

6.3.3 Application. The scope of application of validation is defined by the following requirements and constraints.

a. Principles of operation, system/component description, source codes, schematic and wiring data, shall be validated against engineering source data.

b. Operating and maintenance procedures, including check-out, calibration, alignment, weapon system test, weapon/stores loading, scheduled removal and replacement instructions and associated checklists shall be validated against the system/equipment.

c. Malfunctions will not be introduced into the system or equipment for the purpose of validation unless specifically required for certification of procedural tasks or system tests.

d. Validation shall be performed using an environment and facility closely duplicating service facilities.

e. Only Government-approved support equipment shall be used in validation. Simulation or substitution of support equipment must be approved in writing by the TMMA.

f. When locally fabricated tools or test equipment are approved to perform a procedure, they shall be used during validation, and procedures for fabricating these items shall be included in the technical manual.

g. The preparing activity is responsible for providing or coordinating the requirement for equipment components and support equipment necessary to conduct validation. Requirements not available to the preparing activity shall be made known in writing to the TMMA and shall also be identified in the Validation Plan.

h. Only that part of validation requiring performance of procedural steps or physical comparisons with the hardware can be combined with verification, or waived.

6.3.4 Plan. Unless otherwise specified, a Validation Plan shall be developed. It is a basic planning document generated by the preparing activity to define the methods, procedures, controls, and resources which will be required to accomplish validation.

The plan shall fully describe the methods and procedures to be followed by the preparing activity to ensure that all technical manuals/data delivered under the applicable TMCR are technically accurate, complete, and adequate; that all text and illustrations accurately reflect the equipment(s) covered and conform to the hardware configuration at the copy freeze date; that the data is fully compatible in depth and scope with source coding, established maintenance concept, and the approved logistic support plan; and

that all procedures require only the support equipment authorized by the Navy for the applicable maintenance level.

The plan shall contain sufficient information and detail to permit the TMMT or other reviewing authority to evaluate the preparing activity's understanding of the validation requirement and the adequacy of his proposed program and procedures. As a minimum, the Validation Plan shall establish/define the following:

a. Manuals identified in sufficient detail to permit rapid identification of material to be validated.

b. The cognizant preparing activity organization, site location, and personnel responsible to accomplish the validation effort.

c. Configuration of the hardware of copy freeze date.

d. Frequent and systematic checks of the data under preparation against engineering drawings, engineering orders, design change notices, acceptance specifications, test reports, and most important, MEAR's, PPB's, and the hardware.

e. Steps to be taken to ensure that illustrations and diagrams are consistent with the test and that nomenclature is correct and consistent throughout all of the related publications.

f. Review and validation of all data at crucial points in its development and preparation by engineering, maintenance analysis, product support, and shop personnel. Checkpoints shall be established as necessary to control these crucial functions.

g. Review of all technical data by the preparing activity's Publications Quality Assurance personnel for specification compliance, outline compliance, format, grammar, and layout.

h. Data flow charts which indicate the required routing and sequence of events at each checkpoint.

i. Samples of the checklists or control forms to be used by the reviewer/validator for comment and sign-off.

j. Validation of procedural data by actual performances of procedural steps with records fully documenting the effort to include procedures tested, hardware and testing utilized, data discrepancies found, incompatibilities with the user, and corrective action taken.

k. Listing of hardware, kit requirements, equipment and facilities that will have to be supplied or made available by the Government to support the validation or procedural data.

l. Recommendations for combined validation and verification efforts, either in the field or at the preparing activity if the required equipment/hardware will be unavailable or critical.

m. Outline of the preparing activity's provision for validation or manuals/data procured from a publications or equipment subcontractor.

n. The system of record keeping which will fully document the validation effort, including errors found and recommended methods of correction.

The validation plan shall be submitted to the procuring activity for formal approval, thirty days prior to implementation. The Validation Plan shall be reviewed for approval by the TMMT. Notice of approval shall be forwarded to the preparing activity by the TMMA within forty-five days of receipt of the Valication Plan by the TMMT.

6.3.5 Schedule. Validation is a continuing effort accomplished on all technical manuals, changes, and revisions. It may be initially accomplished as an integral part of research and development for the equipment concerned; however, it will normally be scheduled during routine tests and inspection.

Whenever the preparing activity foresees that it will be unable to validate any element of a manual, the TMMA shall be notified immediately, with full explanation. The TMMA may elect to:

a. Provide the required hardware to the preparing activity.

b. Make facilities and hardware available to the preparing activity at a field location.

c. Combine that portion of validation with verification.

d. Recommend waiver of the validation requirement of applicable elements of the manual. All waivers shall be in writing. Adequate notice shall be provided the Government Representative in order that he may witness or participate as appropriate.

6.3.6 Procedures. Validation of all data shall be accomplished in accordance with the procedures outlined in the approved Validation Plan. In addition to validation against engineering source data, procedural data will be validated against the hardware by actual performance of the procedures.

The contractor or cognizant preparing activity is responsible for selection of the validation site. If unable to conduct the validation effort at his own activity, a recommendation as to the best possible site should be made to the procuring activity.

The validator is responsible for providing for or coordinating the requirement for equipment components necessary to conduct validation. These items shall be reflected as firm requirements in the program milestone chart.

The tasks or instructions being validated shall be performed using an environment and facility closely duplicating service facilities. When space limitations are a known requirement (as in the case of shipboard equipment), they shall be simulated as closely as possible.

Only support equipment as approved by the Government shall be utilized in the performance of validation. Simulation or substitution of support equipment must be approved by the procuring activity. It is the responsibility of the validator to submit

requests for Government-furnished equipment in sufficient time and quantities to support the validation effort.

The contractor is responsible for accomplishing the validating actions listed in his schedule in the manner prescribed in his procedures. Typical steps taken during validation of procedural data are:

a. Writer and technician(s) review all procedural steps to familiarize both with the scope of the task to be performed.

b. After equipment setup and performance of preliminary steps, the technician performs each procedural step exactly as specified in the manuscript.

c. Should a problem arise, engineering assistance may be obtained. When the problem is resolved, the writer notes the procedural changes on the validation record and validation continues until completed.

6.3.7 Criteria. A Technical Manual is not to be considered validated until the following conditions have been fulfilled:

a. Contractor's engineering review has been completed.

b. Technical manual procedures can be used to operate and maintain the system/equipment as stated.

c. Information reflects configuration of system/equipment and includes all engineering changes.

d. Procedural instructions are legible, readable, understandable, and adequate to perform all operations and maintenance functions under job-site conditions.

e. Sequence of operation and maintenance instructions are compatible with performance.

f. Adequacy of data is checked to ensure that it supports approved Maintenance and Support Plan.

6.3.8 Validation Records and Reporting. The manual validation effort shall be fully documented in the form of records maintained by the preparing activity. A record must be made of each segment of the validation effort as it is performed. The record shall identify the data and/or procedure validated, the method of validation employed, the discrepancies found and the corrective action required. It is recommended that, for continuity purposes, the validation record be prepared in a format similar to that of the Verification/Discrepancy Disposition Record shown in Figure 6-3. The records shall be continuously maintained and be available for Government review of justification or certification.

A validation certificate (certification report) is a standard requirement in all procurement actions. The certificate shall list all authorized and unauthorized exceptions, i.e., all items in the manual which have not been fully validated and all items or elements of the manual for which validation was been waived or postponed. The elements of the manual affected and the document authorizing deviation, waiver or postponement should be clearly identified in the case of each item listed. Figure 6-1 is a sample Validation Certificate.

Upon completion of the validation tasks as identified by the plan, and at the time of technical manual submittal for procuring activity acceptance, the manual preparing activity shall deliver a document of certification, attesting to manual adequacy and accuracy and the satisfaction of the validation requirement.

6.4 Verification

6.4.1 Concept. Verification is the process by which technical manuals are tested and proved, under procuring activity jurisdiction, to be adequate for operation and maintenance of equipment procured for operational units. Verification by Fleet personnel is required prior to recommendation of full approval of systems and equipments for service use and should normally be

VALIDATION CERTIFICATE

MANUAL TITLE _____

SYSCOM & NO. _____ DATE _____

CONTRACT/TMCR NO. _____

I. VALIDATION:

Except as stated in II, the technical manual described above has been validated in accordance with all requirements of the TMCR and the approved Validation Plan and is hereby certified to be accurate, adequate and complete. Information and instructions, textual and illustrative, conform in all respects to applicable general and detail specification.

II. EXCEPTIONS: AUTHORIZED BY:

_____

Publications Quality Assurance

Figure 6-1. Sample Validation Certificate

accomplished within a Navy facility of the same maintenance level (organizational, intermediate, depot) as that covered by the technical manual being verified. Personnel of the user's level shall perform the verification. Provisions may be made for performing validation and verification simultaneously when it is beneficial to the Navy. This option may be exercised when: (1) available time, equipment, or facilities do not permit separate validation and verification, or (2) procedures are relatively simple and the chance of error is slight. When combined validation and verification is accomplished at the preparing activity's plant, verification planning will be tailored accordingly.

6.4.2 Participating Activities and Responsibilities. Participating activities and their responsibilities are:

a. Procuring Activity

(1) Recommends maintenance procedures to be verified based on the magnitude and complexity of the procedures.

(2) Determines and coordinates availability of required materials, hardware, equipment, and facilities at the verification site.

(3) Plans verification program.

(4) Establishes verification team membership.

(5) In conjunction with appropriate acquisition organization, selects/designates verification site and activity.

(6) Coordinates verification schedule with all concerned.

(7) Coordinates verification personnel requirements.

(8) Conducts an on-site preverification briefing of participants and attendees.

(9) Coordinates the on-site verification effort; resolves problems and differences.

(10) Conducts an on-site summary conference (critique) at the close of the verification effort.

(11) Determines and coordinates verification follow-up actions required.

b. Preparing Activity

(1) Provides data to be verified, reference data, source documentation, copy of validation records and other documentation, as specified.

(2) Incorporates approved verification actions into formal copy of technical manual.

(3) Rewrites and develops new data, as required.

(4) Provides technical counsel and assistance unless on-site participation has been waived.

c. Verification Activity

(1) Designates on-site liaison personnel, as required.

(2) Provides personnel of appropriate rating(s) to perform the verification tasks.

(3) Hosts the verification effort.

(4) Provides the required facilities, materials, hardware, tooling, and support equipment as coordinated with the TMMT.

(5) Serves as verification recorder.

(6) Serves as on-site verification coordinator when specified by the Technical Manual Manager or TMMT.

(7) Participates in verification follow-up actions when requested by the Technical Manual Manager or TMMT.

d. Cognizant Field Activity

(1) Provides technical assistance when specified by Technical Manual Manager or TMMT.

(2) Provides data, materials, and equipment as coordinated with Technical Manual Manager or TMMT.

6.4.3 Verification Plan. The objective of verification planning is the establishment and implementation of a well organized program for accomplishing the verification goals with minimum interference to the operational, training, or maintenance missions of the verification activity. The instruments for planning the

verification activities are the validation records and quality program supplied by the preparing activity. The Technical Manual Manager or TMMT shall determine the feasibility of accomplishing the verification during scheduled operational, training, or maintenance functions. The Technical Manual Manager or TMMT may designate the verification activity as the on-site verification coordinator.

The verification plan shall consist of the following:

a. Identity of manual or parts of manual to be verified.

b. TMCR number.

c. Recommended verification methods, i.e., table-top review; comparison with hardware; performance of procedural steps.

d. Identification of associated documentation (MEAR's, IPB's, PPB's, specifications, drawings, technical manuals) required for reference.

e. Hardware/equipment configuration at time of copy freeze date.

f. Next higher assembly(ies)/system(s)/components(s) required to support verification.

g. Identification of associated manuals recommended for concurrent or consecutive verification.

h. Manpower requirements by source rating(s) as defined in the Manual of Enlisted Classification, NAVPERS 15105.

i. Personnel support to be provided by the preparing activity (technical writers, engineers, technicians).

j. Material/equipment support to be provided by the preparing activity.

k. Date manual ready for verification.

l. Estimated number of work days required for verification.

m. Special safety precautions.

n. Any special environmental requirements.

o. External power requirements (electrical, hydraulic, pneumatic).

p. Kits or materials required.

q. Support equipment required.

It is recommended that the verification planning data be documented and submitted on forms similar to Figure 6-2 (items 1 through 26).

6.4.4 Verification Procedures. Verification procedures are essentially the same for organizational, intermediate, and depot level manuals. Verification methods include: table-top review, comparison with hardware, performance of procedural steps, or a combination of the three methods. Procedural steps are always verified by actual performance. Typical steps taken during verification of procedural data are:

a. Technician(s) obtain all required equipment/materials supplied by the verification activity.

b. Technician(s) review procedural data to become familiar with steps to be performed and any applicable warnings, cautions, or notes.

c. Verification recorder reads each step aloud and technician(s) perform steps exactly as instructed. Technician(s) verify part numbers referenced in the procedures against the part/equipment.

d. Technician(s) and verification coordinator identify any discrepancies, including safety factors noted during performance of steps.

e. If time permits, verification coordinator obtains on-site engineering assistance to determine required corrective action.

f. Recorder enters discrepancies on Verification Discrepancy/Disposition Record, by defining the deficiency.

VERIFICATION PLANNING DATA

[1]Publication No.: NAVAIR	[2]Title:	[3]Pub Date:	[4]Unclass ☐ Conf ☐ Secret ☐	[5]Organizational ☐ Intermediate ☐ Depot ☐	[6]Planning Data Card No.: _____ of _____

[7]TMCR No.:	[8]Prime Para.:	[9]Subject:	[10]Org ☐ Int ☐ Depot ☐	[11]Table Top Review ☐ Hardware Comparison ☐ Perform Procedures ☐	[12]Reference Documents:

[13]Configuration of Verification Item:	[14]Required Supporting System(s)/Components	[15]Pubs Recommended for Consecutive or Concurrent Verification:

[16]Manpower Required				PREPARING ACTIVITY SUPPORT		[19]Date Ready for Verification:	[20]Estimated No. of Work Days Required:
No.	Rate	No.	Rate	[17]Personnel: Writers _____ Engineers _____ Technicians _____	[18]Material/Equipment:		
						[26]Remarks:	

[21]Special Safety Precautions:	[25]Support Equipment Required:	
[22]Special Environmental Requirements:		

[23]Power Requirements:	ON	OFF
Elect. DC _____ _____		
AC _____ _____ _____ Volts Phase Cycle		
Hyd _____ Psi ___		
Pneu _____ Psi ___		

[24]Material/Kits Required:

VERIFICATION FOLLOW UP

[27]Activity and Site:		
[28]Date Started	[29]Date Completed	[30]No. of Discrep.

Figure 6-2. Verification Planning Data

INSTRUCTIONS FOR VERIFICATION PLANNING DATA FORM ITEMS*

1. Publication number of manual to be verified.
2. Publication title including model/part number.
3. Publication date(s) (issue, revision and change as applicable).
4. Security classification of manual.
5. Maintenance level(s) covered by the manual.
6. Verification Planning Data Card number.
7. TMCR number.
8. Prime paragraph or other element of the manual to be verified.
9. Prime paragraph subject including, if applicable, part number(s) of item(s) being verified.
10. Maintenance level of prime paragraph.
11. Verification method(s).
12. Documents, such as MEARS, PPB's, IPB's, Approved SSE Lists, associated manuals, ECP's, etc., required for reference during verification.
13. Configuration of verification item on copy freeze date (applicable Bureau number, Serial number, model number, part number, directives incorporated).
14. Next higher assembly/system/component required during verification.

    Example: Verification of Organizational level data on a radar power supply would require listing the radar system.
15. Related publications, such as support equipment manuals, that can be verified concurrently or consecutively with the prime verification item.
16. Manpower required, by quantity and rates, to perform the verification tasks. List all requirements, regardless of length of time the man's services will be required.
17. Quantity of writers, engineers and technicians to be provided by the preparing activity in support of the verification.
18. Material/equipment to be provided by the preparing activity in support of the verification. This list will normally be limited to government approved items that are not yet available to Navy activities.
19. Date that the manual or increment of the manual covered by the planning data will be ready for verification.
20. Estimated number of work days required to accomplish verification of the manual, or part of manual, covered by the planning data.
21. Special safety precautions that will require action before starting the verification such as briefing of personnel on peculiar hazards, unusual positioning of switches and circuit breakers; and abnormal on-site fire-fighting equipment.
22. Special environmental requirements such as, temperature, humidity and space limitations.
23. External power requirements.
24. Materials/kits that will be required during verification. Listing shall be by nomenclature and part or specification number.
25. Support equipment required during the verification other than the equipment to be provided by the preparing activity. Common types of test equipment such as voltmeters, signal generators, testers, etc., shall be listed, however, common tools such as screwdrivers, pliers, soldering irons, etc., shall not be listed. Locally fabricated tools or test equipment shall be identified.
26. Any pertinent remarks.
27. Verification activity and site.
28. Verification start date.
29. Verification completion date.
30. Total number of discrepancies recorded.

*Insert "NA" in all blocks not applicable to the manual or element of manual covered by the Verification Planning Data.

6.4.5 Records and Reports. The preparing activity is normally responsible for recording the verification discrepancies. The record shall contain a detailed listing of all manual corrections, changes, or additions to be made as a result of verification. In addition, the representatives of the participating organizations should be identified. Figure 6-3 is a sample form for recording the appropriate information. Figure 6-4 shows some typical verification discrepancy entries.

a. The Technical Manual Manager or TMMT shall review the verification discrepancies and prepare a disposition report specifying corrective action compatible with the user's requirements. The TMMT may elect to:

(1) Consult with the verification activity, as required, to determine the adequacy of the proposed corrective action.

(2) Schedule reverification of all or part of the proposed corrective action.

b. The Technical Manual Manager or TMMT retains original verification planning data and verification discrepancy/disposition record(s) and provides preparing activity with one copy of each form. A copy of the verification discrepancy/disposition record(s) shall also be forwarded to the Defense Contract Administration Services (DCAS) by the Technical Manual Manager or TMMT for use in checking the correction of deficiencies before acceptance of formal manual reproducible (camera-ready) copy.

The preparing activity is responsible for incorporating the approved action in the formal manual before submittal to DCAS for acceptance. The preparing activity is also responsible for maintenance of records reflecting any relocation of corrected data, i.e., paragraph 2-3 of the preliminary manual corrected by new paragraph 2-7 of the formal manual.

VERIFICATION DISCREPANCY/DISPOSITION RECORD

Publication No.: NAVAIR	Prime Paragraph:	Verification Planning Data Card No.: ____ of ____	Verification Date: Start _____ Complete _____	Discrepancy Sheet ____ of ____

Discrep No.	Para., Fig. or Table No.	Verification Discrepancies	Disposition

Verification Representatives		
Verification Activity	Preparing Activity	On-Site Coordinator

Figure 6-3. Verification Discrepancy/Disposition Record

VERIFICATION DISCREPANCY/DISPOSITION RECORD

Publication No.:	Prime Paragraph:	Verification Planning Data	Verification Date:	Discrepancy Sheet
NAVAIR XX-XXX-X	4-8	Card No.: 4 of 7	Start 7-6-69 Complete 7-7-69	1 of 1

Discrep No.	Para., Fig. or Table No.	Verification Discrepancies	Disposition
1	Table 4-2	The unique data contained in table 4-2 would be more usable if contained in table 4-1.	Tables 4-1 and 4-2 will be combined.
2	4-9.d	Torque value should be "50 lb. in. not 50 lb. ft."	Actual torque value required has been determined to be 40-45 lb. in. Manual will be corrected accordingly.
3	Fig. 4-2	Amplifier power source connections not identified.	Connections will be identified.
4	4-12	Need illustration to aid complicated assembly procedures.	Figures will be added to show assembly sequence.
5	4-13.e	Nomenclature used for PN LA2345-67 is not consistent with nomenclature in table of special tools and IPB.	Nomenclature will be changed to agree with IPB.
6	4-18	Add to end of para "Remove the slip ring cover".	Do not concur. Removal of the cover will expose the slip ring to damage during maintenance — although more difficult, the required maintenance can be performed with the cover installed.
7	4-14	PN 3824892 is source coded repairable. Need repair criteria.	Source code in IPB was incorrect and will be corrected to P1C in change dated 9-1-69.
8	4-16	The CAUTION following this para should precede this para.	Will relocate the CAUTION as indicated.

Verification Representatives		
Verification Activity	Preparing Activity	On-Site Coordinator

Figure 6-4. Sample of Completed Verification Discrepancy/Disposition Record

The preparing activity shall submit a Verification Incorporation Certificate when submitting the formal manual for acceptance. Figure 6-5 is a sample certificate.

7. IN-PROCESS REVIEW CHECKLISTS

The checklists which follow as Attachments to this specification are included to facilitate in-process reviews. These checklists cannot assure compliance with contractual requirements, nor can they substitute for expert judgment. However, the checklists can support in-process review by providing a systematic consideration of items which are directly related to quality assurance. The items on the checklists in most cases do not indicate methods by which a quantitative review may be performed, and, again, the judgment of the reviewer is necessary.

The checklists may be used as a means to record review progress and as a means of verifying that a specific requirement has been reviewed and evaluated. Many items will be found to be "not applicable" (N/A) to a particular manual or section and should be checked as such. A "no" answer on the checklists should indicate a less than adequate or questionable compliance with the item under review, and does not necessarily indicate that corrective action is required. Once the complete checklists have been applied, the review team should make the decisions with respect to action based on the number of questionable items checked and what these questionable items seem to focus on.

The checklists are attached in two parts as follows:

Part I PRESENTATION QUALITY - factors that relate to manual comprehension and understandability.

Part II JOB PERFORMANCE ADEQUACY - factors that relate to the adequate support of the user in the job situation.

CERTIFICATE OF INCORPORATION OF APPROVED VERIFICATION DISPOSITION REPORT

MANUAL TITLE _____

SYSCOM & NO. _____ DATE _____

CONTRACT/TMCR NO. _____

I. All the discrepancies and deficiencies recorded during verification of the manual described above have been corrected or resolved in accordance with the Disposition Report as approved and/or modified by:

_____
Cognizant Verification Coordinating Activity Ltr/Msg

II. Remarks:

_____
Publications Quality Assurance

Figure 6-5. Sample Verification Incorporation Certificate

8. GLOSSARY

ADEQUACY - A depth and scope of coverage sufficient to support all tasks and functions at the prescribed maintenance level consistent with provisioning, support equipment selection, and the approved weapon system/item support plan. In Illustrated Parts Breakdown (IPB's), a parts listing and breakdown sufficient to support all intermediate and depot level repairables plus a complete listing of all parts and materials required to support items coded for assembly or manufacture at intermediate or depot level.

COPY FREEZE DATE - Date that the contractor and procuring activity decides no more additions, deletions and changes will be accepted to the publications material. Additions, deletions and changes after that date will be accumulated for preparation of a subsequent change or revision of the publication.

DEFENSE CONTRACT ADMINISTRATION SERVICES (DCAS) - The Government activity designated as contract administrator and having responsibility for acceptance of the manuals delivered to the Navy by a preparing activity.

GROUP ASSEMBLY PARTS LIST (GAPL) - A breakdown of all systems, assemblies, and subassemblies which can be disassembled, reassembled, or replaced and are contained in the end article.

MAINTENANCE ENGINEERING ANALYSIS RECORD (MEAR) - The document which specifies maintenance concept, maintenance requirements and tasks, maintenance personnel and training requirements, support equipment requirements, provisioning materials support, and provides the basis for technical manual approach and content. The MEAR also provides the basis for support requirements status reporting.

PREPARING ACTIVITY (PA) - The organization, whether a commercial contractor or Cognizant Field Activity, holding a Technical Manual Contract Requirement (TMCR) or equivalent document

issued by the Procuring Agency for the preparation and delivery of a technical manual or manuals. In this connection, a subcontractor, vendor, or government activity writing a manual for the PA, or preparing manuscript data or input for the PA, is not to be considered as the Preparing Activity.

PROCURING AGENCY - The appropriate Navy Systems Command as represented by the Technical Manual Management Agency, Cognizant Verification Coordinating Activity, Cognizant Field Activity and/or the cognizant Defense Contract Administration Services.

PROVISIONING PARTS BREAKDOWN (PPB) - A document listing the assemblies, subassemblies, and detail parts of an equipment together with assigned Source, Maintainability and Recoverability (SMR) codes and the related data useful in selecting and programming spare parts support. Also referred to in some documents as a Provisioning Parts List.

TECHNICAL MANUAL (or Manual) - All types and forms of technical publications procured by TMCR (or equivalent) for issue under the cognizance of the appropriate Systems Command.

TECHNICAL MANUAL CONTRACT REQUIREMENT (TMRC) - The document which specifies the technical manuals required for support of an equipment or system and also specifies related contractual requirements.

TECHNICAL MANUAL MANAGEMENT AGENCY (TMMA) - The Naval Air Technical Services Facility (Philadelphia) is the TMMA for the Naval Air Systems Command. The Naval Ship Weapon System Engineering Station (Port Hueneme, California) is the TMMA for NAVSEA.

TMMT (Technical Manual Management Team) - A review team of specially qualified publications personnel and technicians selected to monitor preparing activity technical manual development and preparation tasks. These teams are charged with the responsibility of reviewing proposed technical manual requirements, analyzing and

recommending proposal technical data policy changes, specification deviations and variations, and making appropriate recommendations for approval or disapproval. In addition, they conduct in-process and validation reviews.

CHECKLIST ATTACHMENT
FOR
IN-PROCESS REVIEW

PART I - PRESENTATION QUALITY

IN-PROCESS REVIEW CHECKLIST

PART I - PRESENTATION QUALITY

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1. ORGANIZATION

A. Principal Units and Work Packages	N/A	YES	NO
1. Manual organization is based on a hierarchy of maintainable units or equipment.			
2. Manual organization is compatible with a family tree or topdown breakdown of maintainable units or equipment.			
3. Presentation of equipment or work units follows a logical organization such as order of use, maintenance hierarchy, or according to data flow.			
4. A repair cycle overview is included.			
5. The repair cycle overview is a diagrammatic representation of the succession of maintenance actions.			
6. Diagrammatic overviews of system operation are used instead of or in support of prose system descriptions.			
7. Several layers of overviews are used for larger systems.			
8. "Refer to" problems are eliminated by consolidating all information about a maintainable unit into one package or section.			
B. Arrangement within Sections or Packages			
1. All information concerning a maintainable unit is consolidated into a single package.			
2. The content, format, and sequence of information within a package is standardized.			
3. A "local" table of contents is included to indicate material available within a section.			
4. Pictorials are used to introduce the reader to terminology and physical features of the maintainable unit.			
5. Tools, test equipment, personnel, and other resources are identified at the beginning of the section to which they apply.			

1. ORGANIZATION

B. Arrangement within Sections or Packages (Continued)	N/A	YES	NO
6. System status, valve, meter switch settings, etc. are given at the beginning of the section or operation to which they apply.			
7. Operating descriptions are included in each section or are contained as a whole under separate cover.			
8. A topdown breakdown is provided to establish the referents for the maintenance procedures of the section.			
9. The location for any action is fixed before the description of action is begun.			
10. Trouble analysis aids immediately follow operating descriptions.			
11. Trouble analysis aids are sequenced or grouped in a logical order, e.g., • malfunction verification, • subsystem checks, • fault isolation.			
12. All nontroubleshooting procedures are included in the maintainable unit package as the final content item.			
C. Composition Practices			
1. There is approximately one heading for every two paragraphs.			
2. Headings are set off by spacing, printed in bold lettering or otherwise emphasized.			
3. The ratio of major headings to subheadings is not larger than 1 to 10.			
4. Necessary cautions are listed at the beginning of the operation or, if there are a great many steps, during the operation.			
5. Warnings and cautions are given in troubleshooting tables as the dangers are encountered.			
6. An illustration is located within two pages after the initial reference to it.			

1. ORGANIZATION

C. Composition Practices (Continued)	N/A	YES	NO
7. There is consistency in the manual with respect to: a. formatting in troubleshooting aids, b. abbreviations, capitalizations, nomenclatures, acronyms, c. numbering, d. references.			
D. Prose-Graphic Balance			
1. Approximately half of the material in the manual is text and half is graphic.			
2. Any imbalance between narrative and pictorial favors pictorial in order to minimize procedural errors and performance time.			
3. Pictorial is provided when steps refer to: a. a particular equipment location, b. the relationship between two or more equipment items, c. a specific equipment manipulation (e.g., valve rotation), d. a test readout which is continuous (e.g., waveform) rather than discrete (e.g., numerical value).			
4. Both narrative and diagrammatic portions of Equipment Description materials are itemized, i.e., listed, accentuated or emphasized.			
5. Parts of components mentioned in the text are called out in an illustration.			
6. Explanations are provided that simplify what is happening and, therefore, what might be done to find and correct the situation quickly.			
7. Pictorials should introduce terminology used in upcoming equipment descriptions.			
8. Freestanding graphics are used in preference to text and illustrative graphics.			
9. The text describes what tables contain and how to use them.			

1. ORGANIZATION

D. Prose-Graphic Balance (Continued)	N/A	YES	NO
10. Instructions are provided for the use of complex or unusual figures.			
11. Procedural help for complex portions of wiring and schematic diagrams is provided.			
12. Procedural support is provided on how to troubleshoot complex portions of functional diagrams.			
13. Instructions for use of figures are readily accessible.			
14. Graphics are referred to in complete sentences (not parentheses).			
15. Text referrals to graphics indicate where they are, e.g., Figure 5 on the opposite page.			

2. PROSE COMPREHENSION

A. General Style Principles	N/A	YES	NO
1. A nomenclature pictorial is presented at the beginning of a section.			
2. Pictorials are used to introduce key equipment terminology used in prose discussions.			
3. Short, familiar names are used for hardware once it has been introduced. For example, after referring to a "videodisc proportional spacing word processor with high speed printer," further discussion can simply use the "word processor."			
4. Abbreviations and acronyms are used sparingly.			
5. Concrete and specific statements are used in place of abstract or general statements. • Poor - Accidental contact with these wires can result in third degree burns. • Good - Touching these wires will severely burn you.			
6. Quantitative dimensions or values are given whenever the user must make a selection. • Poor - Drain the oil into a large container. • Good - Drain the oil into a 1 gallon container.			
7. Examples are used rather than analogies.			
8. On each 7 x 9 image-area page there are an average of: • 350 words, • five paragraphs, • two headings.			
9. There is an average of one graphic to support each heading.			
10. Text referrals to graphics indicate where they are, e.g., Figure 5 on the opposite page.			
11. Graphics are referred to in complete sentences (not parentheses).			
12. Instructions are provided for the use of complex or unusual figures.			

2. PROSE COMPREHENSION

A. General Style Principles (Continued)	N/A	YES	NO
13. Paragraphs are limited to a few topics which are clearly and concisely identified.			
14. Instructions for use of complex tables, diagrams, and figures are readily accessible.			
15. Words per paragraph and words per sentence are limited to reduce demands of memory and structural ties on the user.			
16. Clear communication takes precedent over grammatical accuracy.			
B. Instructional Writing			
1. Ninety percent of the maintenance instructions are proceduralized.			
2. Each procedural step has no more than three sentences.			
3. "Second person imperative" is used for instructions, e.g., "Turn the Sensitivity Control to maximum."			
4. Paragraph format is used for presenting instructions.			
5. Steps are numbered and arranged in groups of six or less.			
6. Step content is limited to: a. 25 words or less, b. two or three thoughts, or c. two minutes work time.			
7. Workstation, locator, and equipment detail pictorials are provided.			
8. "Input" page listing requirements for personnel, test equipment, supplies, and equipment conditions are provided.			
9. Instruction reading times and resultant work time is approximately 10 to 15 seconds of reading time for up to two minutes work time.			

2. PROSE COMPREHENSION

C. Paragraphs	N/A	YES	NO
1. Short thought units or "chunks" of information are used in preference to longer units.			
2. Paragraphs are short and have topic sentences.			
3. Long sections of material start with a summary.			
4. Graphics are in view as the related prose is read.			
5. Paragraphs are limited to a few topics which are clearly and concisely identified.			
6. Each paragraph of prose material is limited to no more than three main points. Five or more key points in a paragraph may be presented better as a table.			
7. Topic sentences in a paragraph are especially clear and concise.			
8. Paragraphs are limited to 45 to 60 words.			
9. Peak stress emphasis (underlining, italics, etc.) is used where lengthy paragraphs cannot be avoided.			
10. Paragraph headings are used to facilitate access and to identify the type of material which will follow.			
11. Paragraph headings are consistent with expectancies established by overviews.			
12. Fifty percent of the subparagraphs have headings or lead ins.			
D. Sentences			
1. Sentences generally contain a single idea or thought.			
2. Sentences are limited to 17 to 20 words.			
3. Common and unambiguous verbs are used.			
4. Compound or complex sentences are changed to simple sentences.			
5. Lengthy sentences are avoided.			

2. PROSE COMPREHENSION

D. Sentences (Continued)	N/A	YES	NO
6. Sentences are not arbitrarily shortened to the point that reading becomes jerky and monotonous.			
7. Empty words or unnecessary modifiers are not used. • Poor - Perform the required test. • Better - Perform the test.			
8. Personal sentences are used in place of awkward, passive sentences. • Poor - It should be noted that... • Good - We found that ...			
9. Sentences do not contain unnecessary words. • Simple - all equipment. • Unnecessary - all of the equipment.			
10. Lists within sentences indicate a mutual relationship between a series of things.			
11. Lists within sentences avoid repetition of words that could be part of the body of the sentence.			
12. Sentences with active verbs are generally used in preference to passive verbs. • Poor - The handle should be turned to the right. • Good - Turn the handle to the right. • Good - The handle turns to the right.			
13. Third person indicative is used for Notes and Cautions. For example: • Note - Man B keeps tension on cable until pulley is removed. • Caution - Tank should be empty before inserting probe.			
E. Words			
1. There is an average of 1½ syllables per word based on a count of at least 100 words.			

2. PROSE COMPREHENSION

E. Words (Continued)	N/A	YES	NO

2. Lengthy words are eliminated or "diluted." Use common words in place of less familiar words.

Simple	Awkward
about	as to, with regard to
after	subsequent to
because	inasmuch as, for the reason that
call for	necessitate, require
enough	sufficient
find out	ascertain, determine
for	for the purpose of
get	acquire, obtain, receive
if	in the event that
now	at this time, presently
of	relative to, with regard to
since	inasmuch as
use	utilize

3. Simple prepositions are used.

Simple	Awkward
like	along the lines of
to	in order to
by, under	in accordance with
to	with a view to
about	with reference to
so that	with the result that

4. Simple connectives are used.

Simple	Awkward
so	accordingly
so	consequently
so	for this reason
then	furthermore
so	hence
in other words	that is to say
for example	more specifically

2. PROSE COMPREHENSION

F. Non-Text Words and Phrases	N/A	YES	NO
1. Labels and titles of graphics indicate what they are about.			
2. Nomenclature in the text is defined the first time it is used.			
3. Headings are no more than 3 or 4 words.			
4. Text headings and subheadings accurately describe the text material.			
5. Headings and subheadings divide the text into coherent, self-contained units of information.			
6. Headings and subheadings relate logically within and across sections.			
7. Headings and subheadings are easy to locate in the text.			
8. Out of text notes, cautions, and warnings are easily visible by the border, title, color, or spacing, but in a consistent manner.			
9. Notes, cautions, and warnings are presented at the beginning of an operation before the relevant steps.			
10. Notes, cautions, and warnings are presented during an operation if there are a great many steps.			
11. Special symbols are explained.			
12. Legends, explanatory notes, etc. are descriptive.			
13. Legends, explanatory notes, etc. are readily accessible.			
14. Legends, explanatory notes, etc. do not mask or obscure figure parts.			
15. Legends, explanatory notes, etc. do not contain excess verbiage.			

2. Prose Comprehension

G. Legibility	N/A	YES	NO
1. Page layout generally enhances reading speed and comprehension.			
2. Double column format is used for prose.			
3. Ideal line length is between 14 picas (2-5/16") and 23 picas (3-13/16"). One pica equals .166 inches.			
4. Roman text type face is used for good legibility.			
5. For good legibility, 10 or 11 point (one point = .0138 inches) type is used with 2 point leading.			
6. Word labels comply with minimum type size standards.			
7. Print size and type are adequate for conditions under which figures will be used. Consider such things as illumination, vibration, and wind.			
8. The margins are at least one-half inch wide.			
9. There is extra space between paragraphs.			
10. Lines (as in circuit diagrams and MDCs) are not overcrowded (minimal separation is 1/16").			
11. Figures do not appear cluttered. They can be read clearly under estimated conditions of illumination and distance for use.			

3. GRAPHICS COMPREHENSION

A. General Graphics Principles	N/A	YES	NO
1. General appearance of each graphic page is good. There are no smudges, white space is evenly distributed and graphics appear uncrowded.			
2. Relation of elements on a page is clear.			
3. Graphic fidelity is kept to a minimum for the task at hand.			
4. Scope and level of detail is not excessive for the task at hand.			
5. Graphics titles (if appropriate) are descriptive of the graphic.			
6. Graphics can be read clearly under estimated conditions of distance for user and illumination. Generally, smallest called-out feature is clear when the graphic is viewed at about 4 feet under the illumination available when the task is performed.			
7. The line of regard of a pictorial is the direction from which the technician will view the item.			
8. Line of regard in related figures is logical or variation is explained.			
9. The amount of information included in an image area is controlled to prevent clutter (figure does not appear jammed).			
10. Half-tone figures are sharp, not murky.			
11. Shading or blacking is used to indicate and locate items.			
12. Shading is not excessive.			
13. Legends and notes are located in the left-hand corner of an illustration.			
14. Special symbols are explained.			
15. Legends, explanatory notes, etc. are descriptive.			
16. Legends, explanatory notes, etc. are readily accessible.			

3. GRAPHICS COMPREHENSION

A. General Graphics Principles (Continued)	N/A	YES	NO
17. Legends, explanatory notes, etc. do not mask or obscure figure parts.			
18. Legends, explanatory notes, etc. do not contain excess verbiage.			
19. Legends and keys are repeated on each page of multipage figures.			
20. Relationship between sequential pages of graphics is logical and obvious or explained.			
21. Points of continuity between multipage graphics (exit and entry points) are obvious.			
22. Captions, call-outs and labels are clearly differentiable.			
23. Captions are accurate, descriptive, and located so that there is no confusion in the item to which caption refers.			
24. Word labels comply with minimum type size standards.			
25. Labels are used to show direction.			
26. Arrows and lines do not cross each other.			
27. Arrows and lines are clear and not broken.			
28. There is no uncertainty in what is pointed to or connected by arrows and lines.			
29. Call-outs, labels, arrows, etc. do not cover or obscure meaning.			
30. Multiple call-outs, labels, etc. are aligned.			
31. Direction arrows are used to orient the viewer, e.g., FWD, REAR.			
32. Arrows are used to indicate motion.			
33. Arrows and call-outs are used to emphasize key points of a pictorial.			

3. GRAPHICS COMPREHENSION

A. General Graphics Principles (Continued)	N/A	YES	NO
34. Call-outs are limited to seven or less.			
35. Call-outs are numbered to correspond to instructional steps.			
36. Lines (as in circuit diagrams and MDCs) are not overcrowded (minimal separation is 1/16").			
B. Graphic Form Selection			
1. "Symptom-probable cause-remedy" troubleshooting charts are used where possible causes do not number more than 13 items and where not more than two or three of these are probable.			
2. System-analysis checklists are used in complicated checkout procedures which require checkout of more than one component.			
3. Photographs are used instead of drawings in cases where drawings would need more than very common geometrical shaps to represent the components.			
4. Photographs are used to locate small, unfamiliar objects in a maze of small unfamiliar objects.			
5. Photographs are used to display waveforms.			
6. Photographs are used when working with live and highly dangerous parts.			
7. Photographs are used to aid in recognition of qualitative deterioration of parts.			
8. Drawings rather than photographs are used to show physical characteristics.			
9. Drawings illustrate only items of equipment which are familiar or of concern to the user.			
10. Drawings illustrate equipment areas, pull-out drawers, cables, and principal mechanical elements.			
11. Exploded views are used to show disassembly.			

3. GRAPHICS COMPREHENSION

B. Graphic Form Selection (Continued)	N/A	YES	NO
12. Assembly is shown by a sequence of drawings.			
13. Trends are shown by line graphs rather than bar graphs.			
14. Graphs or alphanumeric tables are used to show relationships between variables.			
15. Network diagrams or symbolic tables are used to explain connections and relationships.			
16. Network diagrams or alphanumeric tables are used to explain sequence or flow.			
17. Alphanumeric tables are used for complex lists.			
18. Logic tree or decision table formats are used to portray branching or multiple alternatives.			
19. Graphs are used rather than tables where single or double interpolation is required.			
20. Signal characteristics/tolerances are specified in pictorial or tabular form.			
21. Good troubleshooting format includes: • symptom statement, • logic statement, viz., why this upcoming step, • abbreviated action statement, • sequence guidance via branching or parenthetical notes, • progress statements for each step or interim conclusion, • tolerance standards, and • conclusion and corrective action.			
C. Schematic and Wiring Diagram Practices			
1. Piece part detail is only shown when replacement is authorized at that level.			
2. The superordinate units containing the circuitry is identified.			
3. Procedural support is provided for complex portions of wiring and schematic diagrams.			

3. GRAPHICS COMPREHENSION

C. Schematic and Wiring Diagram Practices (Continued)	N/A	YES	NO
4. Word labels comply with minimum type size standards, usually 10 point.			
5. Hard copy diagrams are available to facilitate signal tracing.			
6. Points of continuity are labeled between multiple page presentations.			
7. Lines are continuous and unbroken.			
8. Standard electric/electronic symbology is used.			
9. Schematic density should be limited to an average of three elements per square inch or less; there are no more than an average of four intersecting lines per square inch.			
10. At least 1/8" separation is provided between parallel lines.			
D. Network Diagram Practices			
1. Different information elements on diagrams are separated by distance, shading, boxes, or some other method.			
2. The information elements of network diagrams are either familiar symbols, readily understandable alphanumerics or labels, or pictorials.			
3. MDCs connectives and leader lines do not overlap function codes.			
4. MDCs function codes do not overlap each other.			
5. Diagrams use sequencing codes to help in locating work areas and parts.			
6. Network diagrams contain only necessary detail for the task at hand.			
7. Diagrams are not oversized. There are several small diagrams in preference to one large, unwieldy one.			

3. GRAPHICS COMPREHENSION

D. Network Diagram Practices (Continued)	N/A	YES	NO
8. Procedural support is provided on how to troubleshoot complex portions of functional diagrams.			
9. Hard copy is available to facilitate signal tracing.			
E. Block Diagram Practices			
1. Direction arrows are used to show flow.			
2. Flow is left to right and top to bottom.			
3. Height to width ratio of 2 to 3 is used for functional flow blocks.			
4. Diagrams are organized from left to right or top to bottom.			
5. Inputs and outputs are identified as such.			
6. Inputs are on the left and outputs are on the right in block diagrams.			
7. Inputs and outputs are clearly defined or labeled for each block.			
F. Illustrations Practices			
1. Line drawings are used to emphasize relevant items rather than portray faithful physical fidelity.			
2. Relation of parts in exploded views is indicated by axis lines or other obvious connecting lines.			
3. Any feature of a drawing referred to in the text is at least as large as the text type size.			
4. Important dimensions of drawing are at least 1/10".			
5. Call-outs are used to refer to parts of illustrations.			
6. All lines on a pictorial are at least 1/8" apart.			
7. Non-standard symbols (according to MIL-STD-100) are explained in a legend on the illustration.			

3. GRAPHICS COMPREHENSION

F. Illustrations Practices (Continued)	N/A	YES	NO
8. The point of regard for drawings show equipment from the technician's view.			
9. There are no more than five called out items per square inch.			
G. Freestanding or Series Pictorials			
1. In a series of drawings, the first one provides orientation with respect to the major end item of equipment.			
2. Arrows or lines show progression from less to more detailed drawings.			
3. Relation of elements in a series of pages of sequential figures is clear.			
4. Drawings progress from contextual (equipment plus surrounds) to enlargements to exploded views when supporting procedures.			
5. In a series of drawings, the first one provides orientation with respect to the entire system (e.g., aircraft).			
6. Each time the technician must move to a new location, a new contextual (locator) or workstation graphic is given.			
7. Freestanding pictorials have information on the graphic itself when possible - not in the text.			
H. Tables Practices			
1. Interpolation is not required in numerical look-up tables.			
2. Title reflects content variables.			
3. Headings are clear and scale units are included as needed in headings.			
4. Data elements within the table are easily related to the row and column headings which specify their location.			

3. GRAPHICS COMPREHENSION

H. Tables Practices	N/A	YES	NO
5. Elements within the table are roughly equal in information content (or gross differences are justified by the nature of the table).			
6. If there are multielement cells, elements within cells are clearly separable (e.g., by type size or type character).			
7. Information follows a natural order or scaling (e.g., or elements within a row/column are related to each other).			
8. If the items in a table are measurable, the scaling unit is specified in a heading or beside each entry.			
9. Inputs into tables are readily apparent.			
10. Element content is intelligible and makes sense in context.			
11. Column headings are aligned with elements and adjacent to them.			
12. Units are specified in column heads.			
13. Rows either have row headings or labeling is not needed because of an intrinsic order.			
14. Row entries are arranged in groups of six or less.			
15. Row entries are alphabetized if necessary.			
16. Elements are aligned within column and row.			
17. If a table is comprised of numbers, the numbers are aligned on a decimal point or right-hand justified.			
18. The vertical dimension of a table is greater than the horizontal dimension.			
19. There are fewer columns than rows.			
20. There are no empty rows or columns.			
21. Tables are not compressed and information is easy to find. In general, there should be 25% white space.			

3. GRAPHICS COMPREHENSION

H. Tables Practices (Continued)	N/A	YES	NO
22. The table is enclosed in a border.			
I. Graphs Practices			
1. Graphs usually have only a single concept.			
2. Comparison between data is shown on the same graph.			
3. Graph scales do not distort the intended relationships.			
4. Grid interval of .1 to .3 inch is used (inch minimum).			
5. Grid lines are 0.015 to 0.0125 inch wide.			
6. Axes are oriented naturally, e.g., altitude on vertical axis.			
7. Title reflects graph variables.			
8. Instructions and illustrations are provided for use with complex graphs.			
9. A legend is provided for non-standard symbols.			
10. Multilayed bars of a graph are connected with lines to emphasize comparisons.			
11. Graphs are enclosed in a border.			
J. Photograph Practices			
1. Photographs show equipment from the technician's view.			
2. Photographic views indicate uncommon shape or dangerous components.			
3. Photographs are retouched to help orientation of the workers.			
4. Photographs are retouched to keep fidelity and detail to a minimum.			
5. Photographs locate small, unfamiliar objects in a maze of pieces.			
6. Photographs show qualitative deterioration of parts.			

4. READABILITY MEASUREMENT

	N/A	YES	NO
Testing technical material to obtain a "readability" score is not a standardized or agreed upon procedure. Furthermore, readability means different things to different people. However, readability is an important factor in quality assurance. Therefore, a procedure for calculating the Fog Index, a measure of the understandability of reading matter, is included as a part of these checklists. The Fog Index is easy to apply and to calculate. It provides a direct measure of readability in terms of educational level.			
THE FOG INDEX			
Purpose			
Overall measure of readability of test material.			
Procedure			
Identify several sections containing written text. Scan each section for the types of writing it contains. Select two samples for each type of writing within each section. Record the selected samples of the Fog Index Worksheet. Use the Worksheet for the following.			
Calculate average sentence length. Count 100 words; if not at the end of a sentence, stop the count with the end of the sentence nearest 100 words. Record the number of words and sentences.			
$\text{ASL (average sentence length)} = \frac{\text{\# words}}{\text{\# sentences}}$			
Reconsider the first 100 words of the approximately 100-word sample. Exclude words which are equipment names or nomenclature, and extend the sample by the number of words needed to total 100 again.			
Count the number of words of three syllables or more in the extended 100-word sample. Don't count words that are three or more syllables because an "ed" or "ing" has been added to them.			
%HW (hard words) = number of 3 or more syllable words counted.			
Calculate the Fog Index. FI = (ASL + %HW) x 0.4.			

4. READABILITY MEASUREMENT

Results	N/A	YES	NO

The Fog Index values agree closely with educational levels of reading difficulty. A Fog Index of 12 means that students at the 12th grade level could be expected to answer correctly 90% of a set of questions testing their reading of the material. For the component parts of the Fog Index, the averages are as follows:

School Grade	ASL	%HW	Total	FI
12	20	9	29	11.6
10	18	6	24	9.6
8	15	5	20	8.0
6	14	3	17	6.8

FOG INDEX WORKSHEET

Publication Title and Number _____ Reviewed by _____

_____ _____

_____ Date _____

NOTE: Select two samples at random for each type of writing with each section.

EVALUATION STANDARDS

School Grade	Average Sentence Length (ASL)	Average % Hard Words (% HW)	Total	Fog Index
12	20	9	29	11.6
10	18	6	24	9.6
8	15	5	20	8.0
6	14	3	17	6.8

Section	Page	Avg. Sentence Length (ASL)			% HW	TOTAL (ASL + %HW)	Fog Index 0.4 (TOTAL)
		Number Words	Number Sentences	ASL			

CHECKLIST ATTACHMENT
FOR
IN-PROCESS REVIEW

PART II - JOB PERFORMANCE ADEQUACY

IN PROCESS REVIEW CHECKLISTS - PART II

-JOB PERFORMANCE ADEQUACY-

		Page
1.	ACCESS AND SEARCH	II-1
	A. Identification	II-1
	B. Sections or Packages	II-1
	C. Table of Contents and Headings	II-2
	D. Index	II-2
	E. Reference Compliance	II-3
2.	USABILITY AND ACCEPTANCE	II-5
	A. Information Content Adequacy	II-5
	B. Job Relevance and Efficiency	II-7
	C. Workplace and User Compatibility	II-7
	D. Technical Scope and Accuracy	II-8

1. ACCESS AND SEARCH

A. Identification	N/A	YES	NO
1. The title page reveals the purpose of the manual and the system or equipment for which it is used.			
2. A full page illustration of the equipment is provided near the front of the manual.			
3. Manual breakdown is based on a hierarchy of maintainable units or work packages.			
4. A family tree or topdown breakdown of maintainable units is provided.			
5. The manual includes charts or tables showing the interchangeability of components, cables, and assemblies for particular systems, and they are easy to locate.			
6. Items do in fact appear in the text when they are listed in the: a. table of contents, b. list of figures, c. list of tables, d. index.			
B. Sections or Packages			
1. A "local" table of contents is used to indicate material available within a section or package.			
2. Test equipment is listed in tables to show how and when it is needed.			
3. Tables show availability of test points for use in trouble-shooting procedures.			
4. A repair cycle overview is included. This is a diagrammatic representation of the succession of maintenance actions.			
5. Illustrations are within 2 pages of where they are referenced in the text.			
6. There are no "refer to's" outside of a section in the manual.			

1. ACCESS AND SEARCH

B. Sections or Packages (Continued)	N/A	YES	NO
7. Internal references (e.g., "see," "refer to") are used rather than repetition when there are ten or more lines of text.			
8. Internal references are easy to locate and there are no secondary referrals.			
C. Table of Contents and Headings			
1. The table of contents has a logical sequence from topic to topic.			
2. The table of contents consistently lists all text headings of the same level.			
3. Each heading and subheading is referenced at least once in the table of contents or index.			
4. The minimum number of table of contents entries is one per page of manual content.			
5. Paragraph headings are consistent with expectancies established by overviews.			
6. Text headings are informative.			
7. Headings are used to facilitate access and to identify the type of material which will follow.			
8. Fifty percent of the subparagraphs have headings or lead-ins.			
9. The average number of headings per page is two.			
D. Index			
1. Any text heading not in the table of contents is in the index.			
2. The minimum number of index headings is one per page of manual content.			
3. The index is set up in alphabetical order.			

1. ACCESS AND SEARCH

D. Index (Continued)	N/A	YES	NO
4. The index is set up in a manner as to make the location of trouble-shooting procedures for individual problems possible.			
5. Symptoms are indexed either in the back or front of the manual.			
6. As some items can be located under several headings, there are notations under main headings showing where they may be found.			
7. The index contains as a minimum listings of subsystems, equipment and items, maintainable assemblies, or job functions.			
8. The average ratio of headings to subheadings is no greater than 1 to 10.			
9. The manual includes a glossary of technical terms.			
E. Reference Compliance			
1. Official part number and nomenclature used on title page to identify the technical manual. (MIL-M-38784)			
2. Inclusion of listing of technical directives (changes and bulletins) covered by the manual.			
3. Applicable safety precautions included. (MIL-M-38784)			
4. All abbreviations and technical terms fully explained and identified. (MIL-M-38784)			
5. Nomenclature consistent within the manual and with directly related publications. (MIL-M-38784)			
6. In the case of IPB's, source control, specification control and vendor part numbers listed in the GAPL according to MIL-H-8910.			
7. Source codes listed in the numerical index (IPB).			
8. IPB numerical index contains all part numbers listed in the PPB. (MIL-H-8910)			

1. ACCESS AND SEARCH

E. Reference Compliance (Continued)	N/A	YES	NO
9. Breakdowns and GAPL in the IPB consistent with source coding.			
10. References made to other manuals in the IPB GAPL when appropriate.			
11. Material listed in the GAPL of the IPB for all items coded for local manufacture.			
12. Adequate instructions included in the maintenance manual for the fabrication of items coded for local manufacture.			

2. USABILITY AND ACCEPTANCE

A. Information Content Adequacy	N/A	YES	NO
1. Initial system conditions for maintenance activities are specifically identified for such factors as: a. gaining access, b. removing fluids, c. pressurizing/depressurizing, d. raising/lowering, e. energizing/de-energizing, f. warm up/cool down.			
2. Initial equipment conditions, prior to operations or maintenance, are specifically identified for such factors as: a. switch position, b. valve position, c. recorder settings, d. meter settings.			
3. Maintenance checkpoints are identified and expanded on in terms of: a. their location, b. appropriate measurement equipment, c. tolerances at each checkpoint, d. parameters for alternate modes, e. unusual procedures or cautions.			
4. Special instructions are included for hazards, warnings and cautions, or other unique situations such as: a. problems in seeing and recognizing gross indications, b. problems in reading quantitative values, c. problems in detecting relative motion between components, d. problems in reading or interpreting oscilloscope patterns or wave forms, e. noting visually detectable defects, f. presence or absence of unique sounds and vibrations, g. discriminating characteristics of sounds, i.e., pitch, loudness, roughness, duration, h. special odors, i.e., burnt insulation, leaking fluids, exhaust gases, i. critical decisions in selecting next step or task, j. special calculations, k. areas requiring technician's judgments, l. problems in switch activation, m. problems in adjusting controls			

2. USABILITY AND ACCEPTANCE

A. Information Content Adequacy (Continued)	N/A	YES	NO
n. problems in performing gross body movements, o. problems in performing fine coordinated movements.			
5. Special tools, equipment, and supplies needed for maintenance are identified to permit the technician to obtain them before going to the work site. This includes: a. tools not normally included in tool kit, b. test equipment, c. special supplies and expendables, d. special forms.			
6. Personnel requirements are clear with respect to the following: a. skills required (an extra pair of hands or a technical specialist), b. communication requirements, c. sequential and simultaneous performance requirements.			
7. Equipment identification and location information is provided in terms of contextual drawings; use of enlargements; or exploded views.			
8. Preparation of the work area, including arrangement and location of support items, personnel, and technical materials, is clearly presented.			
9. Work station location and personnel position portrayals are clearly illustrated or described in terms of standard nomenclature and/or readily recognizable features.			
10. Adequate instructions are included in the maintenance manual for the fabrication of items coded for local manufacture.			
11. Coverage is compatible with MEARS, source coding and companion manuals. (Sampling)			
12. Follow-on actions are identified for each possible outcome of the maintenance or operation package.			

2. USABILITY AND ACCEPTANCE

B. Job Relevance and Efficiency	N/A	YES	NO
1. All information concerning a maintainable unit is consolidated into a single package.			
2. Manual sections or packages contain only that information required to support job performance.			
3. Information not relevant to the job or excess detail is eliminated.			
4. All items of test equipment and tools needed in an operation are listed at the beginning of that operation.			
5. All personnel needed to assist in the operation are listed by title with an indication of what and when they are to perform.			
6. Pictorials to introduce the reader to terminology and features of the maintainable unit are provided.			
7. The location of any action is fixed before the description of action is begun.			
8. Cautions and Warnings are clearly identified by color, borders, spacing, or some other emphasis feature.			
9. The content, format, and sequence of information within a package is standardized.			
10. Graphics and related prose are arranged for simultaneous viewing.			
11. Hard copy of trouble-shooting aids is provided to facilitate use at the job site.			
C. Workplace and User Compatibility			
1. The manual specifies what might be done to make the working situation as ideal as possible.			
2. Specific instructions are given for special maintenance which might be required in unusual climatic conditions of cold, heat, wind, altitude, and noise.			
3. The manual is constructed so as to allow the removal and addition of pages.			

2. USABILITY AND ACCEPTANCE

C. Workplace and User Compatibility (Continued)	N/A	YES	NO
4. The manual is constructed to be convenient in size as regards working space (pocket-size = 5" x 8" x 1½", desk size = 8½" x 11").			
5. Foldouts are not used or are minimized.			
6. Foldout pages are consistent in the "Pyramid Gate Fold."			
7. A highly reflective matte rather than glossy paper is used.			

D. Technical Scope and Accuracy

Technical scope and accuracy is not amenable to a checklist type of review. Tests for scope and accuracy are more appropriately a part of Validation and Verification rather than In-Process Review. The questions of concern are:

1. Is the information in the manual technically accurate?
2. Is there enough information in the manual to adequately support job performance?

As part of In-Process Review, however, a form of adequacy check may be performed. NAVAIR 00-25-600 defines an adequacy check and suggests a procedure as indicated below.

> The objective of an adequacy check is to determine the degree to which depth and scope of coverage in maintenance manuals, and the parts listing and breakdown in IPB's are sufficient to support repairables, replaceables and items to be assembled or manufactured within the Navy establishment.
>
> To perform an adequacy check, it is advantageous to work in groups, one person working with PPB, one with the IPB and one with the maintenance manual. The person with the PPB searches out items coded repairable, replaceable, to be assembled or manufactured. The part number and nomenclature of these items is called out, along with the source code,

2. USABILITY AND ACCEPTANCE

D. Technical Scope and Accuracy (Continued)	N/A	YES	NO
and the person working with the IPB determines if it contains the proper artwork and parts breakdown while the person working the maintenance manual ascertains if the depth of coverage supports the source/maintainability/recovery code. At the same time, the approved support equipment listing can be checked to assure that support equipment called out in the maintenance procedure is approved and compatible.			

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